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Review Article

Reconceptualizing Shukra Dhatu through Andrology, Endocrinology, and Cell Biology: A Narrative Review

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Abstract

Background: As per Ayurveda, the human body is composed of seven *Dhatus* (tissues), among which *Shukra Dhatu* represents the final and most refined essence. It is regarded as the essence (*Sara*) of all preceding Dhatus and is primarily composed of *Jala Mahabhuta*. The principal function of *Shukra Dhatu* is *Garbhotpadana* (reproduction), which can be considered with modern concepts of reproductive hormones and cellular regeneration. Objective: To reinterpret the Ayurvedic concept of *Shukra Dhatu* through the perspectives of andrology, endocrinology and cell biology thereby providing an integrative understanding of its biological correlates and functional relevance in contemporary medical science. Methodology: This review was conducted through a comprehensive analysis of classical Ayurvedic literature, including the works of *Acharya Sushruta*, *Charaka*, and *Vagbhata*. Relevant texts and scientific articles were critically examined to correlate traditional descriptions of *Shukra Dhatu* with physiological and endocrinological concepts in modern science. Results: *Shukra Dhatu* is present throughout the body, not confined solely to the reproductive organs. *Acharya Sushruta* and *Vagbhata* describes the existence of *Stree Shukra* (female counterpart), highlighting the universality of reproductive potential. *Shukra* also contributes to the formation of *Ojas*, the vital essence responsible for immunity, vitality, and overall well-being. The nourishment and replenishment of *Shukra Dhatu* through *Rasayana* and *Vajikarana* therapies demonstrate its role in tissue rejuvenation and sustained physiological balance Discussion: *Shukra dhatu* functions parallel to hormonal regulation, reproductive health, and systemic vitality. It governs reproductive capacity and systemic vitality, symbolizing cellular regeneration and neogenesis. Conclusion : Shukra dhatu can be understood as a concept that reflects reproductive health, hormonal balance, and body's capacity for renewal and regeneration. Viewing shukradhatu through the perspectives of andrology , endocrinology and cell biology helps bridge classical Ayurvedic knowledge with contemporary scientific understanding.

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Introduction

The human body is composed of *Dhatus*, the fundamental structural and functional units of body tissues. There are seven *Dhatus*, collectively known as *Saptadhatu*, namely *Rasa*, *Rakta*, *Maṃsa*, *Meda*, *Asthi*, *Majja*, and *Sukra*. Among these, *Sukra Dhatu* is regarded as the *Sara* (essence) of all other *Dhatus*. Just as each *Dhatu* pervades the entire body, the *Sukra dhatu* too is present throughout the body. *Sukra* pervades the entire living body, just as juice runs through sugarcane, ghee is inherent in curd, and oil is infused within sesame seeds. (1) According to *Acharya Caraka*, *Sukra* is constituted by all the *Mahabhutas* except *Akasa*. *Acharya Chakrapaṇi* further explains that although *Akasa* is universally present, it does not have a direct functional role in *Sukra*. In contrast, *Acharya Susruta* states that *Sukra* comprises all the *Mahabhutas* but is predominantly *Saumya* in nature, reflecting its inherent *Kapha* dominance.(2)

Sukra Dhatu is essential for *Beejartha*, as it enables the generation of healthy offspring. Although its chief function pertains to reproduction, it also provides comprehensive nourishment to the body, enhancing physical strength, immunity, and emotional balance. *Sukra* is intimately connected to the formation of *Ojas*, the vital essence that sustains immunity, vigor, and overall vitality of the body. (3)

Classical Ayurvedic Perspective of *Sukra Dhatu*

Embryologically, *Sukra Dhatu* represents the generative tissue, not merely the sperm. The generative tissues and organs develop

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from the *Sukra Dhatu Kala*, which is distributed throughout the body. *Ayurveda* describes *Sukra* as the terminal and most refined form of the bodily tissues, regarded as the *Parama Tejas*,the supreme essence,of all other *Dhatus*.

Location

Sukra is distributed throughout the body in the form of *Sukradhara Kala*, the structural substrate responsible for sustaining and regulating the functions of the generative tissue. According to *Acharya Caraka*, *Sukra* pervades the entire body, just as sweetness pervades sugarcane, ghee is inherent in curd, and oil is infused within sesame seeds (*tila*). During copulation, it is discharged from both the male and the female as a result of sensory stimulation arising from physical contact, imagination, and mutual arousal much like water oozing out of a wet cloth when squeezed.(4)

Properties

It is *guru* (heavy), *snigdha* (unctuous), *madhura* (sweet), and *drava* (fluid) in nature. It possesses the fragrance of *Madhu* (honey) and has a semifluid consistency, often resembling oil, honey, or ghee in appearance and texture. Its normal quantity is described as *Ardha Anjali*. (5)

Mahabhautika composition of *sukra*

Acharya Caraka states that *sukra* is composed of all the *bhutas* except *Akasa Mahabhuta*. Although *Akasa* pervades *Sukra* due to its ubiquitous presence in the body, it is absent in the *Sukra* during ejaculation. (6)

Functions

According to *Acharya Susruta*, the functions of *Sukra Dhatu* include: *Dhairya* (courage), *Chyavanam* (ejaculation), *Pṛiti* (affection), *Dehabala* (physical strength), *Harṣa* (exhilaration), and *Bijartha* (procreation). (7)

Formation

- *Sukra* is formed from the *Snehabhava* present in *Majja*. It oozes out through the pores of bones, shaped by the influence of *Vayu*, *Akasa*, and other elements, much like water seeping from a newly made earthen pot. (8) *Majja Dhatu* here can be represented as *Mastaka Majja*. The hypothalamus may be considered the *Mastaka Majja*,the central regulator of reproductive functions. Its *ghṛta-svarupa* (unctuous, nourishing quality) reflects the neuroendocrine integration and the lipid-rich composition of brain tissues involved in hormonal synthesis. (9)
- The hypothalamus secretes Gonadotropin-Releasing Hormone (GnRH), which stimulates the anterior pituitary (*adenohypophysis*) to release Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH). These hormones then act on the gonads (testes or ovaries) to promote gametogenesis and the secretion of sex hormones.

Materials and Methods

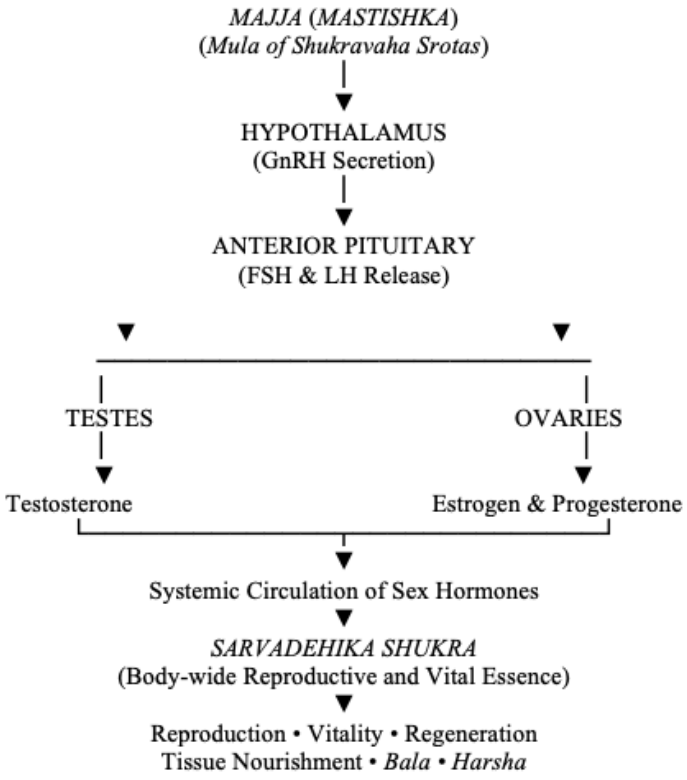
A Narrative review was conducted through a comprehensive analysis of classical Ayurvedic literature, including the works of *Acharya Sushruta*, *Charaka*, and *Vagbhata*. Relevant texts and scientific articles were critically examined to correlate traditional descriptions of *Shukra Dhatu* with physiological and endocrinological concepts in modern science. In addition , a structured literature search was performed across major electronic databases, incuding PubMed, Scopus, Web of science, and Google scholar. The search strategy employed relevant keywords and Boolean operators to identify studies pertaining to shukra dhatu and its possible correlations with modern scientific concepts. The search terms included “Shukra dhatu, ” “Shukra AND endocrinology,” “shukra AND andrology,” “Shukra AND Cell renewal,” “hypothalamo pituitary gonadal axis,” “gametogenesis,” “cell regeneration,” and “tissue renewal.” Duplicate data, non-relevant studies and articles lacking scientific relevance were excluded. Recent research conducted in the respective field was also taken into consideration, thereby developing an integrative perspective on its physiological significance.

Results and Discussion

Comparative Analysis: *Shukra Dhatu* and Endocrine Correlates

As mentioned, *Sukra Dhatu* is derived from *Majja Dhatu*, and according to *Aṣhṭanga Sangraha*, the *Mula Sthana* of *Sukravaha Srotas* is *Majja*. However, *Acharya Dalhan* also uses the term *Majja* to refer to the brain (*Mastishka*). (9) In this context, *Majja* signifies the brain, and modern science identifies the hypothalamus, located in the brain, as the central regulator of the pituitary gland.

Figure 1: Shukra dhatu and HPG Axis



In short, the characteristics of *Sarvadehika sukra* described in Ayurvedic texts closely correspond to the features of male and female sex hormones as understood in modern science, suggesting a remarkable similarity between the two. (10)

Functional equivalence

In modern medical science, *Sukra Dhatu* cannot be equated with a single anatomical or biochemical entity. However, based on its functions as described in *Ayurveda*, certain structures and

chemicals, particularly hormones can be correlated with *Sukra* due to their similar physiological roles.

Dhairya is a quality associated with *Sattvika Prakriti* and is defined as the firmness and steadiness of the mind, enabling an individual to uphold righteousness and withstand adversity.(11) A lack of *Dhairya* can make a person more vulnerable to mental disturbances. Modern research supports this connection, demonstrating that gonadal hormones play a key role in mood regulation. Fluctuations in estrogen in women can increase susceptibility to anxiety and depression, while testosterone provides protective and stress-buffering effects.(12) In this way, the Ayurvedic concept of *Dhairya* closely mirrors the psychoneuroendocrine functions of testosterone and estrogen.

Acharya Dalhana explains that ejaculation (*Sukra Niṣkramana*) depends on *Dhairya* and is facilitated by eight factors: *Harṣa* (excitement), *Tarṣa* (desire), *Sara* (fluidity), *Picchilata* (viscosity), *Gurutva* (heaviness), *Anubhava* (atomicity), *Pravaṇabhava* (tendency to flow), and *Drutamaruta* (*Vata* activity). (13) Among these, *Harṣa* and *Tarṣa* act as psychological triggers, while the remaining factors reflect the physical properties of *Sukra* that ensure smooth emission. Classical Ayurvedic descriptions align with modern physiology, where erection is mediated via parasympathetic pathways, and emission/ejaculation occurs through sympathetic discharge from the T12–L2 spinal segments. This interplay of psychological and physical factors highlights an early understanding of the integrated mind–body mechanism. (14)

Dehabala (body strength), as described by *Acharya Dalhana*, encompasses *Deha Upachaya* (physical development) and *Utsaha* (vitality/enthusiasm). (15) In men, testosterone plays a central role in increasing muscle mass after puberty on average about 50% more than in women while also promoting protein anabolism, bone matrix formation, and calcium retention. In women, estrogens help maintain bone health by inhibiting osteoclastic activity and supporting protein balance, with deficiencies contributing to osteoporosis later in life.(16) Thus, the Ayurvedic concept of *Dehabala* closely parallels the anabolic and musculoskeletal effects of testosterone in men and estrogen in women.

The symptoms of *Sukra Kshaya* such as fatigue, infertility, and erectile dysfunction, correspond closely with the clinical features of androgen deficiency. A clinical case study on azoospermia (complete absence of sperm) associated with *Sukra Kshaya* further supports this connection. The study participants exhibited fatigue, weakness, and infertility, mirroring the manifestations of low testosterone levels in modern medicine. (17)

Table 1: Shukra kshaya lakshana and Modern correlations

Shukra kshaya lakshanas	**Probable modern correlations**
Fatigue (S*hrama*), Weakness (S*adana*)	General fatigue, low energy (Androgen deficiency)
Pallor, Anaemia (P*anduta*)	Low red blood cell production (testosterone-linked)
Impotence, Infertility (K*laibya*)	Erectile dysfunction, reduced fertility
Erectile Dysfunction (*Klaibya*) due to *Shukra Kshaya*	Weak reproductive tissue, poor androgen support

When *Sukra* is abnormally increased, it can lead to conditions such as *Sukrasmari* (seminal calculi) and *Ati Stri Kamata* (excessive craving for women and sexual activity)(18). These Ayurvedic descriptions can be correlated with hyperandrogenic states, characterized by elevated testosterone or heightened androgen activity, which are known to increase libido and promote unusual sexual desire. (19)

***Shukra sara* & Endocrine corelates**

The classical description of *Sukra Sara* in Ayurveda highlights features such as luster, clarity of voice, stable mind, and reproductive vitality.(20)

From a modern perspective, these attributes reflect not only reproductive potential but also overall systemic health. The term *Kṣheerapoorṇa Lochana*, which describes milky-white, lustrous eyes, may relate to healthy function of the meibomian glands,known androgen target organs. Deficiency of androgens can impair these glands, leading to meibomian gland dysfunction and evaporative dry eye, which mirrors the loss of vitality described in *Sukra* depletion.(21) Recent evidence indicates that imbalances in testosterone, estrogen, and progesterone levels can disrupt the lacrimal functional unit, promote inflammatory changes within it, and contribute to the pathophysiology of dry eye disease. (22)

Priya-darsana (pleasant appearance) and *Slakṣna-tvac* (smooth, radiant skin) may correspond to balanced androgen activity along with physiological levels of estrogen, both of which play crucial roles in maintaining sebaceous gland function, collagen integrity, and overall tissue vitality. Androgens exert their effects on the skin by binding to nuclear androgen receptors, which are widely distributed across various skin components, particularly in the sebaceous glands, where they stimulate cell proliferation and lipogenesis, contributing to a healthy and radiant complexion (23). Estrogen helps maintain skin moisture by enhancing the synthesis of acid mucopolysaccharides and hyaluronic acid in the skin, while also supporting the barrier function of the stratum corneum, thereby preserving hydration and skin elasticity (24). *Suddha Snigdha Svara* finds its endocrine correlate in testosterone-mediated vocal resonance, particularly observed in males. Elevated testosterone levels during puberty cause lengthening and thickening of the vocal folds, resulting in a deeper and more resonant voice (25). In females, estrogen and progesterone contribute to the feminization of the voice by influencing vocal fold characteristics and resonance. A study by Palani et al. found that serum TSH(thyroid stimulating hormone), FSH (follicular stimulating hormone), LH (luteinizing hormone), and PRL(prolactin) levels exhibit a negative correlation with semen parameters, whereas testosterone shows a positive correlation, highlighting its key role in maintaining male reproductive health (26). Furthermore, *Arogya* (low disease susceptibility) can be understood in modern terms through parameters such as seminal oxidative stress status, total antioxidant capacity, and DNA integrity,factors now recognized as important biomarkers of both fertility and overall systemic health (27).

***Sukra dhatu* as new cell growth**

The preceding *Dhatus* nourish *Sukra*, which in turn supports the creation of new life. *Sukra* governs not only reproductive capacity through gametogenesis but also systemic vitality and renewal. In modern terms, this can be viewed as a symbolic representation of cellular regeneration and neogenesis. The replenishment of *Sukra Dhatu* through *Rasayana* and *Vajikaraṇa* therapies reflects the Ayurvedic principle of promoting new tissue formation and restorative physiological processes. Conversely, depletion of *Sukra Dhatu* (*Kṣaya*) leads to diminished regenerative potential, manifesting as infertility, fatigue, and degenerative changes within body tissues.

Generative Potential: Susruta states, *"Sukra is the very essence of all dhatus, responsible for creation of offspring"* (7) This aligns with the concept of gametogenesis, continuous formation of new reproductive cells.

Regenerative Capacity: Vagbhata acharya emphasizes that *"From the well-nourished Sukra arises ojas, which sustains life* (28) This indicates that *Sukra* is not merely reproductive tissue but also the foundation of systemic renewal and vitality.

Sukra "sarva-dhatusara" (essence of all tissues) .(29) This implies that it contains the blueprint of all preceding *dhatus*, much like modern genetics recognizes gametes as carriers of the complete cellular code for regeneration of a new organism. Thus, *Sukra* may be seen as a conceptual substrate for new growth , both of progeny (cellular reproduction at organismal level) and of tissues (cellular regeneration at individual level).

Current research indicates that bone marrow-derived mesenchymal stem cells (BM-MSCs) possess significant differentiation potential. Their therapeutic effects are largely mediated through the release of bioactive molecules, including growth factors, cytokines, and extracellular vesicles. These factors modulate the local cellular environment, promote tissue repair, angiogenesis, and cell survival, and exert anti-inflammatory effects, highlighting their regenerative and restorative capabilities. (30) Studies on BM-MSC transplantation into germinal cells have demonstrated that these stem cells can successfully induce spermatogenesis within the seminiferous tubules of azoospermic hamsters. Cell therapy using BM-MSCs facilitated rapid repair of pathological changes in the testicular tissue and effectively restored fertility in busulfan-induced azoospermic hamsters. These promising results suggest the potential application of BM-MSCs as a therapeutic strategy for treating azoospermia in humans. (31)

Seminal parameters such as sperm count, motility, and volume can serve as modern proxies for assessing the quality of *Sukra Dhatu*. *Sukra Dhatu Sara* reflects the supreme quality and functional excellence of *Sukra*. The *Sukravaha Srotas* can be correlated with the male reproductive system, and the qualities of *Sukra Dhatu* described in the *Samhitas* closely resemble the characteristics of semen. Optimal quality of both *Sukra* and semen is essential for the generation of healthy offspring, i.e., reproduction. Therefore, *Sukra Dhatu* can be effectively correlated with semen based on their shared qualities and functions.

***Shukra sara purusha* with quality of semen**

Understanding *Vajikarana* it is one of the eight branches of Ayurveda. The word *Vajikarana* comes from the word *Vaji*, which means horse and stands for power and strength. The main goal of *Vajikarana* therapy is to strengthen and nourish *Sukra Dhatu*. This improves sexual health, reproductive health, and general vitality

The use of *Rasayana* therapy has been a cornerstone of Ayurvedic practice since ancient times, renowned for its rejuvenating and restorative effects. Herbs like *Ashwagandha, Shatavari, Shilajit*, and others exert their benefits at multiple levels: they act as nutritional supplements (*Poshaka Rasa*), enhance metabolic function (*Agni*), and nourish the body's channels and tissues (*Srotas*).(32,33,34) Some *Rasayana* formulations specifically target individual *Dhatus*; for instance, *Vrishya* and *Balya* herbs directly support *Sukra Dhatu*, promoting its production and functional vitality. Beyond their tissue-specific effects, many *Rasayana* herbs also possess immunomodulatory properties, helping to strengthen or restore the body's immune defenses, thereby contributing to overall health and resilience. In addition, *Rasayana* medications have been shown to exert tissue- and disease-specific immunomodulatory effects, supporting overall immunity while also demonstrating anti-stress, inotropic, and antioxidant activities, which collectively contribute to improvements in patients' quality of life (QOL).(35) Given the central role of *Sukra* in reproduction, *Aṣhtanga Ayurveda* regards it as the ultimate bodily tissue, emphasizing that its optimal health is essential for producing healthy offspring and achieving intimate well-being. Within this framework, *Vajikaraṇa Tantra* addresses a wide range of physical and psychological sexual concerns, including impotence, low libido, premature ejaculation, weak erection, and female infertility. *Vajikaraṇa* therapies work by correcting imbalances or deficiencies in *Sukra Dhatu*, nourishing it, enhancing digestion, improving nutrient absorption, and ultimately promoting the production of high-quality *Sukra Dhatu*, to support reproductive and systemic vitality.(36)

Vajikaraṇa Rasayana is a specialized category of *Rasayana* that specifically supports the reproductive system and enhances sexual function. These formulations act on higher brain centers, including the hypothalamus and limbic system, which regulate sexual desire and reproductive processes. Additionally, *Vajikaraṇa Rasayanas* possess anti-stress and adaptogenic properties, helping to reduce anxiety and improve sexual performance and overall reproductive well-being**.** (36) Chauhan et al. demonstrated that administration of *Vajikaraṇa Rasayana* specifically ethanolic extracts of *C. orchioides*, *A. longifolia*, and *M. pruriens* modulated the levels of pituitary hormones FSH and LH.(37) This hormonal regulation partially explains the observed positive effects of these herbs on sexual function.

Conclusion

Sukra, as the refined essence of all *Dhatus*, embodies vitality, stability, and regenerative potential. Its functions closely parallel those of the endocrine system, particularly the hypothalamo–hypophyseal–gonadal axis, which regulates hormonal balance and reproductive health. As the final product of *Dhatu* transformation, *Sukra* can be understood in modern terms as a reflection of the body's ongoing processes of cell renewal and tissue maintenance, mirroring the roles of hormones and cellular signaling pathways in supporting growth, repair, and reproduction.

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